

# Alka-Seltzer<sup>®</sup> Rainbow



## Introduction

Produce a quick and moving rainbow of colors with an Alka-Seltzer<sup>®</sup> tablet and a little vinegar.

## Concepts

- Acid–base reactions
- pH indicators

## Materials

Alka-Seltzer, 1 tablet	Vinegar, CH <sub>3</sub> CO <sub>2</sub> H, 10 mL
Sodium hydroxide, NaOH, 0.1 M, 100 mL	Beaker, 600-mL
Universal indicator, 10 mL	Graduated cylinders; 500-mL, 100-mL and 10-mL
Water, distilled, 350 mL	Stirring rod

## Safety Precautions

*Sodium hydroxide solution causes skin and eye irritation. Universal indicator is an alcohol-based solution and thus a flammable liquid and vapor. Keep away from heat, sparks, open flames, and hot surfaces. May be harmful if swallowed or in contact with skin. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. Please review current Safety Data Sheets for additional safety, handling, and disposal information.*

## Preparation

1. Measure out approximately 350 mL of distilled water in a 600-mL beaker.
2. Add 100 mL of 0.1 M sodium hydroxide solution.
3. Add 10 mL of the universal indicator solution and stir. The solution should now be a dark purple.
4. Pour the solution into a 500-mL graduated cylinder.
5. Use a clean graduated cylinder to measure out 10 mL of vinegar.

## Procedure

1. Drop an Alka-Seltzer tablet into the 500-mL graduated cylinder. Color changes should begin to occur as soon as the first carbon dioxide bubbles are formed.
2. When the tablet rises to the top, add about 10 mL of vinegar to the solution. The solution should now be red on the top.

## Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures, and review all federal, state and local regulations that may apply, before proceeding. All materials may be disposed of according to Flinn Suggested Disposal Method #26b.

## Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

**Disciplinary Core Ideas: Middle School**

MS-PS1 Matter and Its Interactions  
 PS1.A: Structure and Properties of Matter  
 PS1.B: Chemical Reactions

**Disciplinary Core Ideas: High School**

HS-PS1 Matter and Its Interactions  
 PS1.A: Structure and Properties of Matter  
 PS1.B: Chemical Reactions  
 HS-PS2 Motions and Stability: Forces and Interactions  
 PS2.B: Types of Interactions

**Science and Engineering Practices**

Analyzing and interpreting data  
 Constructing explanations and designing solutions

**Crosscutting Concepts**

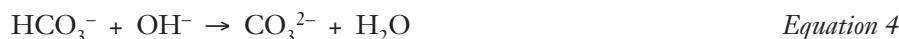
Patterns  
 Cause and effect  
 Structure and function

**Tips**

- The Alka-Seltzer tablet may be placed in the graduated cylinder before adding the sodium hydroxide solution. The reaction occurs immediately as the solution is added, producing a rainbow of colors with more motion.
- Hydrometer cylinders or 600-mL tall form beakers can also be used. This demonstration can also be scaled down using half the reagents and a 250-mL graduated cylinder.
- To get the best rainbow of colors, add the vinegar as soon as the yellow color appears.

**Discussion**

The Alka-Seltzer tablets contain sodium bicarbonate and citric acid. As the Alka-Seltzer tablet dissolves in water, the citric acid reacts with the sodium bicarbonate to produce carbonic acid (Equation 1) and carbon dioxide (Equation 2). The carbonic acid then reacts with the basic sodium hydroxide to change the pH of the solution (Equations 3 and 4). As the base is consumed, the solution will slowly become more acidic, resulting in the color changes.



The Alka-Seltzer tablet initially sinks to the bottom of the cylinder. As the carbon dioxide bubbles adhere to the tablet, the tablet begins to rise and eventually floats. The buoyancy of the tablet and the final addition of vinegar (a weak acid) lead to a pH gradient. Universal indicator makes the pH gradient visible and produces the characteristic rainbow of colors.

**Acknowledgment**

Special thanks to Charles Ophardt, Ph.D., Elmhurst College, Elmhurst, IL, for bringing this demo to our attention.

**Materials for Alka-Seltzer® Rainbow are available from Flinn Scientific, Inc.**

Catalog No.	Description
A0111	Alka-Seltzer Tablets, 24/pkg
S0149	Sodium Hydroxide, 0.1 M, 500 mL
U0001	Universal Indicator, 100 mL
V0005	Vinegar, White, 4 L

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.